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(71) Applicant : **PAPER TECHNOLOGY INTERNATIONAL LTD.**
29-31 Kylie Place
Cheltenham, Victoria 3192 (AU)

(72) Inventor : **Leigh, Ralph Peter**
7 Beatrice Avenue
West Heidelberg, Victoria 3081 (AU)
Inventor : **Bancroft, Peter**
29 Kylie Place
Cheltenham, Victoria 3192 (AU)

(74) Representative : **Bannerman, David Gardner et al**
Withers & Rogers
4 Dyer's Buildings
Holborn
London, EC1N 2JT (GB)

(54) Method and apparatus for forming pads.

(57) A method and apparatus for forming a pad (1) having a plurality of sheet elements (2) interconnected along an edge portion (3) thereof by adhesive tape (4). The method includes feeding a strip of sheet element material (29) to a tape applying station (46), applying adhesive tape to the sheet element strip in such a manner as to overlap an edge portion (3) thereof to form a composite band (56) of material, superimposing a plurality of layers of the composite band (56) at a pad formation facility (59) in order that the overlapping tape portion of one layer adheres to an immediately adjacent layer to form a pad block.

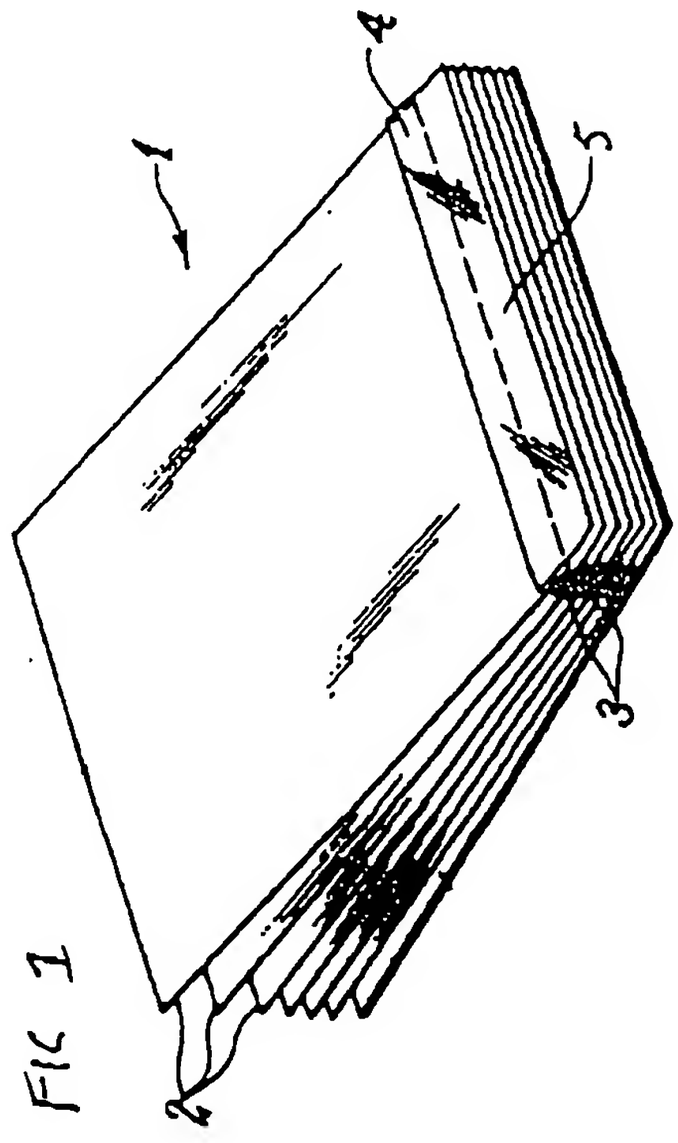

FIG 1

EP 0 664 225 A1

This invention relates to pads of the kind which are made up of a plurality of sheets stacked one upon the other, and each of which may be adapted to carry information which is applied as required. The invention is concerned with a method and apparatus for forming such pads, and particularly such pads which have sheets formed of paper, a paper based material, or any other suitable material.

An example pad of the foregoing kind is described in the specification of Australian Patent 522249. That specification also describes a method and apparatus for forming the pad. The apparatus described in that patent includes an elongate work surface on which successive layers of individual sheet elements are placed, one on top of another, with each sheet element having a layer of adhesive tape applied to an edge thereof. The adhesive tape overlaps the edge to which it is applied, so that it adheres to the layer of tape of the sheet strip located directly underneath and a plurality of such layers serve to form the pad. The method described in that patent, includes provision of sheet portions of a surface area sufficient to form a plurality of pads, and pad blocks formed of those sheet portions are passed through a guillotine or the like to divide each block into a plurality of pads of the elected size.

In accordance with that prior method, a pad block could be formed by two parallel, spaced apart sub-blocks of sheet portions, individual layers of which are secured together in a spaced-apart configuration by the self-adhesive tape. Each section of that tape not only serves to adhere the sheet portions of each separate sub-block together, but also serves to adhere together adjacent overlying sheet portions of each spaced apart sub-block. The composite pad block thus formed is guillotined through the centerline of the tape junction existing between the sub-blocks in order to separate them. The separated sub-blocks can be further guillotined as necessary, if the length of the sub-block is sufficient to form a plurality of individual pads lengthwise.

While machines according to the above patent are satisfactory in producing pads of good quality, the elongate work surface is cumbersome and requires the presence of two operators. Further, the tape application is time consuming and requires particularly accurate positioning of the sheet portions.

It is an object of the present invention to overcome or at least minimise the aforementioned problems. It is a particular object of the invention to provide an improved method and apparatus for forming multi-sheet pads of the kind in which adjacent sheets are releasably attached to one another by a strip of adhesive tape.

According to the present invention there is provided a method of forming a pad having a plurality of sheet elements interconnected along an edge portion thereof by adhesive tape, said method including feeding a strip of sheet element material to a tape applying station, applying adhesive tape to said sheet element strip in such a manner as to overlap an edge portion thereof to form a composite band of material, superimposing a plurality of layers of said composite band at a pad formation facility in order that the overlapping tape portion of one layer adheres to an immediately adjacent layer to form a pad block.

In a preferred form of the method, the composite band passes through a separation station at which it is cut or otherwise severed transversely to form separate portions of square or rectangular form. Each such portion is composed of a section of the material strip previously referred to, and a section of adhesive tape. The square or rectangular portions so formed are superimposed on top of one another to form a primary stack in which each section of adhesive tape overlies and is aligned with adjacent sections of that tape.

The adhesive tape is preferably applied on a continuous basis at the tape applying station so that a composite band of material emerges from that station.

The present invention a machine for forming a pad having a plurality of sheet elements interconnected along an edge portion thereof by adhesive tape, said apparatus including feed means for feeding a strip of sheet element material to tape applying means which is operative to apply adhesive tape to said sheet element strip, said application being such that the tape extends in the longitudinal direction of the sheet element strip and overlies a longitudinal edge portion of said strip so as to adhere to that edge portion and form a composite band of material, successive layers of said composite band being assembled together at a pad formation facility such that successive layers are adhered to the immediately adjacent layer by the adhesive tape to form a pad block.

The composite band may then be fed to a pad formation facility, where layers of the composite band are assembled in such a manner that successive layers are adhered to the immediately adjacent layer by the adhesive tape. Pads formed in this manner may be further processed as necessary, particularly if they are formed as large pad blocks which require guillotining or other like processing to reduce the size of the pad block into a plurality of smaller individual pads.

The tape applying means serves to apply tape to an edge portion of the sheet element strip in a continuous manner and to enable such continuous feed, the tape is preferably provided in the form of a tape roll supported on a rotatable shaft, with the tape being fed on to the applicable edge portion as that portion passes in the region of the tape roll.

It is also preferable that the sheet element strip be in the form of a continuous roll and that the feeding means include a rotatable shaft, on which the roll is

rotatably supported. Such an arrangement enables the feed means to continuously feed the pad material to the tape applying station.

The pad formation facility preferably includes separating means for separating discrete sheet element portions from the composite band. The separating means preferably includes a rotary knife edge cutting assembly, which may be electronically controlled to rotate at an appropriate frequency suitable to separate sheet element portions of a particular length relative to the feed rate of the sheet element strip. The electronic control may include sensing means which operates to sense when a rotation of the rotary cutting assembly is required and such sensing means may include an electronic eye which operates to sense appropriate markers. It is preferable that markers either be printed on the pad sheeting, or be located on a calibrated rotating disc which rotates at a rate fixed relative to the rate at which the sheet element strip is fed from the feed means.

The pad formation facility may further include means to convey the sheet element portions to a location where they may be assembled one upon another, in a manner which forms a pad block of the sheet element portions. The conveying means may include suction means and a conveyor belt such that each sheet element portion may be moved into contact with the conveyor belt under the effect of the suction to such an extent that the sheet element portion moves with the conveyor and is conveyed to the assembly location. At the assembly location, release means may be employed to release the sheet element portion from the suction effect. Successive sheet element portions may be released at the same location, with the adhesive layer of one sheet element portion adhering to the preceding sheet element portion. Pressure means may be employed to ensure adequate adhesion between successive sheet element portions and such pressure means may form part of the release means.

In a preferred form of the invention, the sheet element strip is of a width equivalent to at least the minimum width of two sheet elements which are to eventually form the pads according to the invention. In this embodiment, the apparatus according to the invention includes cutting means located prior to the taping station to separate the pad material longitudinally into a plurality of reduced width sheet element sections approximately equal to the desired width of the eventual sheet elements. It is generally envisaged that the sheet element strip will be separated into two reduced width sheet element strips only, although any number of reduced width strips may be separated from the original sheet element strip. It is also generally envisaged that the reduced width strips will be of equal width although again, that is not absolutely necessary.

The cutting means may simply slit the sheet element strip, or it may remove an intermediate section. In this latter case, tape can then be applied to the opposed edges of the newly formed reduced width strips preferably by a single roll of tape, which roll is of sufficient width to overlap both of the opposed edges, thereby forming a composite band of spaced apart sheet element portions. Pad blocks formed from such a composite band may be further processed to sever the tape connection existing between adjacent reduced width strips and this may be achieved by guillotining, although other means may be appropriate to achieve this.

In order to assist in arriving at an understanding of the present invention, a preferred embodiment is illustrated in the attached drawings. However, it should be understood that the following description is illustrative only and should not be taken in any way as a restriction on the generality of the invention as described above.

Figure 1 shows a prior art pad of a type to be manufactured by the present invention.

Figure 2 shows a schematic view of a machine according to the present invention.

Figure 3 shows a perspective view of a feeding arrangement.

Figure 4 shows a plan view of a cutting disk assembly.

Figure 5 shows a perspective view of a taping station.

Figure 6 shows a schematic view of an alternative taping station.

Figure 7 shows a perspective view of a pad formation facility.

Figure 1 is a reproduction of the Figure 1 which is illustrated in Australian Patent No. 522249, although several of the reference numerals have been removed. That figure shows a pad generally indicated by the numeral 1 and including a plurality of sheet elements 2 each having an edge portion 3. A strip of self-adhesive tape 4 is adhered to each of the sheet elements 2 along the edge portions 3. Each strip of tape 4 has a portion 5 thereof overlapping its respective edge portion 3 and removably adhering to the overlapping portion 5 of the immediately adjacent strip of tape 4. With such an arrangement each sheet element 2 and the strip of tape 4 adhered thereto can be removed from the pad 1 and subsequently adhered to an object. The description in Australian Patent No. 522249 relating to the pad shown in Figure 1, is hereby incorporated by cross reference. It is desired that a machine according to the present invention be capable of use in a process to produce pads similar in form to those shown in Figure 1.

Figure 2 shows a schemetic layout of a machine 10 according to the present invention which is suitable to manufacture a pad similar to that shown in Figure 1. The layout is indicative of the principle on which the machine operates, but is not to scale and does not

show parts of the machine such as the supporting frame. Figure 2 is merely an illustration showing the basic components of a machine according to one embodiment of the invention. The machine 10 includes feeding means generally indicated by the numeral 11. While the feeding means may take any one of a number of forms, in the embodiment shown, the feeding means 11 includes a rotatable shaft 12 on which a supply of pad sheeting, in the form of a sheeting roll 13, may be mounted. In this embodiment, the shaft 12 is mounted within bearings 14, which are supported by mounting means 15 and the pad sheeting 13 rotates about the axis of the shaft 12. In this embodiment, the mounting means 15 is formed as part of the frame of the machine 10.

The feeding means 11 may include suitable brake or clutch means to prevent uncontrolled rotation of the sheeting roll 13. In the particular embodiment shown in Figure 3, the shaft 12 includes a spur gear 16 and this engages a geared ring 17 connected to the inside of a rotatable disc 18. The rotation of the disc 18 is restricted under the influence of pressure applied to it by the disc brake 19 and thus a braking force is applied to the shaft 12 through the spur gear 16 and the geared ring 17. The disc brake 19 preferably operates under the effect of pneumatic pressure which may be varied by means of a pressure regulator 20.

An electronic clutch arrangement may alternatively be used and many known clutch arrangements may be appropriate. Electronic control of the clutch arrangement advantageously provides high precision control of the tension in the sheeting roll 13, so that as the diameter of the roll decreases and the rotational velocity of the roll increases, constant tension in the sheet being taken from the sheeting roll can be maintained.

The feeding means 11 may also include loading means suitable to facilitate loading of the sheeting roll 13 into position on the mounting means 15. Suitable loading means 21 are generally shown partly in phantom in Figure 3. While only one side of the loading means is shown in Figure 3, a duplicate arrangement to that shown is preferably located on the opposite side of the machine 10. The loading means 21 includes lifting arms 22, pivotable about the axis of the shaft 23 and actuated under the action of a pneumatic actuator 24, although any other suitable actuator may be applied.

To load a sheeting roll 13, the rotatable shaft 12 is firstly inserted into the desired sheeting roll 13 and then the shaft 12 and the roll 13 are manoeuvered into a position adjacent the notched ends 25 of the lifting arms 22. Upon actuation of the pneumatic actuator 24, outward movement of the piston 26 causes the lifting arms 22 to pivot about the shaft 23, thereby raising the notched ends 25 of the arms 22 which serves to engage the suitably positioned rotatable shaft 12. Upon further outward extension of the piston 26, the lifting arms 22 act to lift the rotatable shaft 12 and attached sheeting roll 13. The arms 22 continue to lift the roll 13 until the rotatable shaft 12 is adjacent the mounting means 15, such that it can be manoevered and loaded into the mounting means 15. Once mounted, the piston 26 may be retracted to return the lifting arms 22 to their initial rest position ready for loading or unloading the rotatable shaft/sheeting roll assembly as necessary.

To securely locate the rotatable shaft 12 within the mounting means 15, a clamping arrangement may be employed. While other forms of clamping arrangements may be applicable, the clamping arrangement shown in Figure 3 includes a lever 27 which clamps a cross-bar 28 into position against an upper surface of the bearing 15. This clamping arrangement is effective in securely locating the rotatable shaft 12 and also allows simple, one movement releasing of the clamp by hand. Such clamps are suitable for location on the bearings 14 on either side of the rotatable shaft 12.

As discussed previously, it is preferable that the sheeting roll 13 have a width equivalent to at least the minimum width of two sheet elements 2, each of which will eventually form the basis of a pad such as that shown in Figure 1. The machine 10 shown in Figure 2 is designed to accommodate a sheeting roll 13 of such a width dimension and the advantage of this assembly will become apparent hereinafter.

The sheeting roll 13 feeds a continuous sheet 29 through the machine 10 in the direction of arrow A. The sheet 29 passes around roller shafts 30 and 31, inbetween which may be located tensioning means to apply tension against the sheeting roll. The tensioning means shown in Figure 2, is in the form of a tensioning bar 32, which is of a substantially rectangular configuration and is mounted so as to be rotatable about its longitudinal axis, although the axis of rotation may in one embodiment be located toward one edge of the bar. The tension force exerted on the sheet 29 is variable depending on the orientation of the bar 32 with respect to the sheet 29 and will increase gradually as the bar 32 is rotated in the direction of arrow B to the position indicated in phantom in Figure 2. Further rotation in this direction will serve to further increase the tension on the sheet 29, although overtensioning may serve to tear or otherwise damage the sheet 29.

The tensioning means may be dispensed with where suitable control of the sheet tension is maintained by other means such as the brake or electronic clutch arrangements previously discussed. A tensioning sensor may however be adopted to feed a signal back to the control station of the brake or clutch arrangement, so that that arrangement may self adjust to maintain a constant tension.

With an appropriate sized sheeting roll 13, the sheet 29 may then be exposed to a cutting assembly and a suitable cutting assembly is generally indicated

by the numeral 33 in Figure 2. The cutting assembly 33 is located after roller shaft 34 and is shown in more detail in Figure 4.

The cutting assembly 33 of Figure 4, preferably includes a cutting wheel 35 having two spaced apart annular knife edges 36, although the configuration of the knife edges may vary from that shown. The cutting wheel 35 may be rotatably mounted on a shaft 37 by virtue of suitable bearings (not shown). A wheel 38 is rotatably mounted on a shaft 39 and is located in the space 40 between the knife edges 36 of the cutting wheel 35. As the sheet 29 passes between the cutting wheel 35 and the wheel 38, it is pushed against both of the knife edges 36 and the segment 41 of the sheet 29 is severed, thus creating two separate sheet portions 42 and 43 separated by a distance equivalent to the width of the segment 41 which is removed. As an alternative, the cutting assembly may only include one knife edge 36, whereby the sheet 29 will be slit instead of having the section 41 removed.

While the wheel 38 is shown in Figure 4 as projecting slightly within the space 40 between the oppositely located knife edges 36, the distance shown is not indicative of that required for effective operation of the cutting assembly, as this may vary depending on the type of material constituting the sheet 29. The position of the shaft 39 is preferably variable to enable adjustment of the wheel 38 into and out of the space 40, such that a variable cutting force is available to be applied where necessary to the sheet 29.

As can be appreciated, the width of the segment 41 which is removed by the cutting assembly of Figure 4 can be varied by using a cutting wheel 35 having movable knife edges 36, adjustable along the longitudinal axis of the shaft 37, or by having a selection of cutting wheels 35 with differing knife edge spacings. In the latter case, the wheel 38 is preferably replaceable to suit the particular cutting wheel 35 in use at any one time.

Scrap removal means may be provided to remove the scrap segment 41 which is severed by the cutting assembly 33. In one form, the scrap removal means may include a wheel 44 which rotates in a direction indicated by arrow C. The wheel 44 is preferably driven in synchronicity with the feed rate of the sheet 29, or alternatively, a variable drive motor may drive the wheel 44 so that the drive velocity can be readily adjusted to the rate at which the scrap is to be removed.

The removal of scrap in this embodiment is accomplished by winding the segment 41 about the outer periphery of the wheel 44. It has been found that the segment 41 will wind on to the wheel 44 without the need to include outer guiding flanges or the like, unless there is sufficient movement in either the segment 41 or in the wheel 44 to make that necessary.

Alternatively, a scrap receptacle acting under vacuum may be used to receive the scrap segment 41 and to remove it under the effect of a vacuum force.

Sheet portions 42 and 43 continue about roller shaft 45 toward the taping station generally indicated by the numeral 46 and this is shown in more detail in Figure 5. The taping station 46 includes a supply of self-adhesive tape preferably in the form of a tape roll 47 supported by a bearing (not shown) located on a shaft 48. The shaft 48 may be supported by an arm 49 which is connected to a stationary shaft 50 which in turn is connected to the frame of the machine 10. The taping station 46 may further include a tape application roller 51 supported by an arm 52 also connected to the stationary shaft 50. The tape application roller 51 preferably rests against a roller shaft 53 about which the sheet portions 42 and 43 pass. In this embodiment, tape from the tape roll 47 is fed between the tape application roller 51 and the roller shaft 53 where the tape simultaneously engages the oppositely located edges 54 and 55 of the sheet portions 42 and 43. Pressure at the contact point between the tape application roller 51 and the roller shaft 53 serves to bond the self-adhesive tape to each adjacent edge 54 and 55, such that the sheet portions 42 and 43 are joined together by the self-adhesive tape and form a composite sheet or band 56.

An alternative arrangement for the taping station 46 is schemetically illustrated in Figure 6. This arrangement is particularly useful in high speed operation of the machine 10, given that the less complicated version illustrated in Figures 2 and 5 is sometimes conducive to tape breakage because the tension in the tape exceeds acceptable levels.

The arrangement of Figure 6 includes a driving mechanism for driving the tape roll 47. The driving mechanism is not illustrated, but may be constituted by any known driving means and in a preferred arrangement, is an electric motor coupled to the shaft 48, such that rotation of the shaft 48 by the motor also causes rotation of the tape roll 47.

Driving the tape roll 47 in that manner reduces tension on the tape 80 feeding from the tape roll, even though it is still "pulled" away from the tape roll 47 by the tape application roller 51 in contact with the roller shaft 53. That is, because rotation of the tape roll 47 is not effected by the pulling action of the tape application roller 51 and the roller shaft 53, but instead is effected by the driving force of the driving mechanism. Thus the tension in the tape needs simply be enough that the tape 80 can be peeled off the tape roll 47 as the tape roll rotates.

An electric motor for driving the tape roll 47 is advantageous in that it can be coupled to the feed mechanism of the sheet 29 and as the diameter of the tape roll 47 reduces, the speed of the electric motor can be increased to compensate for that reduction. A sensor can be attached to the arrangement so that the diameter of the tape roll 47 can be constantly monitored and that sensor in one embodiment may react to the

relative angular position of the arm 81. The arm 81 may be pivotally mounted and biased so that the outer surface 82 of the tape roll 47 is maintained in contact with the roller 83 during feed of tape 80 from the tape roll 47, such that a certain angular disposition of the arm 81 serves to indicate when the tape roll is nearly finished.

The tape 80 extends about rollers 84 and 85, the latter of which is also pivotally mounted on an arm 86 so as to compensate for minor variations in the tension of the tape 80. The tape then extends about the roller 87 and then to the tape application roller 51 and roller shaft 53, where it is applied to the sheet 29 in the same manner as previously described.

The composite sheet 56 then passes about roller shaft 57 and drive roller 58. The drive roller 58 is so positioned in this embodiment, that the sheet 29 and composite sheet 56 are pulled through the machine 10 by the drive roller 58 from the feeding means 11. By locating the drive roller 58 downstream of the feed means 11 and the taping station 46, there is no need to provide drives to "push" the sheet 29 through the machine 10. By pulling the sheet 29 through the machine 10, a degree of tension is maintained in the sheet 29 along with the effect of the braking arrangement or alternative arrangement as appropriate applied to the feeding means 11 and the tensioning bar 32.

The drive roller 58 may be driven by any suitable means, but in a preferred arrangement, the drive is by way of a toothed rubber belt. A rubber belt of this kind requires no lubrication, is simple to operate and maintain, is particularly quiet during running conditions and results in minimal vibration generation.

The drive roller 58 is preferably located adjacent the pad formation facility which is generally indicated by the numeral 59 (Figure 2). The pad formation facility serves to separate individual sheet element portions from the composite sheet 56 and may also serve to assemble a predetermined number of those portions to form a pad block. The sheet element portions referred to above may be of any appropriate size and may be large enough that a plurality of pads may subsequently be formed from one pad block comprising a plurality of layers of sheet element portions. As previously discussed, when the machine shown in Figure 2 includes the arrangement of Figures 4 and 5, at least two individual pads may subsequently be formed from a single pad block, given that, in that arrangement, each sheet element portion includes two oppositely located sheet elements, integrally connected by a web of adhesive tape. Therefore, if the length of each sheet element portion is equal to the length of only one sheet element 2 as shown in Figure 1, then a pad block formed from a plurality of such sheet element portions will be of sufficient size to form two pads after guillotining or other such processing to sever the oppositely located sides of the pad block through an appropriate line of the adhesive web. Therefore, by increasing the length of the sheet element portions, the number of pads formed from one pad block may be increased thereby also increasing the efficiency of the machine 10.

The pad formation facility includes sheet element portion separation means and in the embodiment of Figure 2, this is shown schematically as a rotary guillotine 60. The position of the guillotine 60 is also indicated in Figure 6, however, the structural details of the guillotine are not shown for clarity purposes. Other forms of guillotines may also be appropriate, for example a vertical guillotine may also successfully be used. However, the rotary guillotine 60 is particularly advantageous in this embodiment, as its rotational speed can be set to match the horizontal speed of the composite sheet 56 and therefore, in contrast to a vertical guillotine which requires the composite sheet 56 to be stationary as the sheet is being cut, no reduction in the horizontal speed of the composite sheet 56 is necessary as it passes the rotary guillotine 60.

The sheet element portions 61 (Figure 7) which are progressively separated from the composite sheet 56 by the rotary guillotine 60, are engaged by conveying means in order to convey the portions 61 in a direction indicated by the arrow D, to a pad block assembly location. While any suitable conveying means may be utilised for this purpose, the conveying means employed in the embodiment shown, includes conveying belts 62 and 63. The belts 62 and 63 run between conveyor rollers 64 and 65 and in the lower run of these conveyors, the belts 62 and 63 run parallel to and adjacent channel members 66 and 67. Channel members 66 and 67 are hollow and include a longitudinal opening along the underside thereof, such that a suction force may be applied within the channel members, which suction force acts against the lower run of the belts 62 and 63.

The suction force may be applied to the channel members 66 and 67 by any suitable means and in the embodiment shown, a vacuum motor is connected via hose 68 to hollow cross channel 69 which is in communication with the channel members 66 and 67. The conveying belts 62 and 63 include perforations or openings 70 to enable the suction force within the channel members 66 and 67 to pass therethrough and exert a suction force against each sheet element portion 61.

The suction force exerted on each sheet element portion 61 supports that sheet element portion against the conveying belts 62 and 63, which serve to convey that sheet element portion to a pad block assembly location. When the sheet element portion 61 reaches the assembly location, release means are employed to release the sheet element portion from the effect of the suction force. While many forms of release means are possible, in the embodiment according to Figure 7, the release means is in the form

of a push bar 71 which is located between channel members 66 and 67. The push bar 71 is connected to an actuating cylinder 72 which may be pneumatically operated, so as to raise and lower the push bar 71 at predetermined intervals. The actuating cylinder 72 may be connected directly to a pneumatic source, or it may be connected via a pressure regulator, whereby the pressure exerted on the push bar 71 may be varied. Alternatively, a solenoid actuator may be adopted and electronically actuated. A solenoid actuator is preferred over a pneumatic actuator given the improved accuracy of electronic control over pneumatic control. Any suitable solenoid actuator may be adopted.

The push bar 71 serves to push successive sheet element portions 61 away from the suction force within each of the channel members 66 and 67. The push bar 71 may futher serve to apply sufficient force to adhere the self adhesive tape located between sheet portions 42 and 43 of successive sheet elements portions 61, to the back of the self adhesive layer of the preceding sheet element portion 61. By varying the pressure exerted by the push bar on the sheet portions, an effective adhesion between successive sheet portions 61 can always be assured. The adhesion of successive sheet element portions 61 serves to form the pad block.

The suction force is advantageous for at least two reasons, namely, that it brings each sheet element portion 61 into contact with the conveying belts 62 and 63, but it also advantageously lifts the adhesive side of the adhesive tape away from contact with the already positioned sheet element portions, so that it does not adhere to any surface prematurely, ie. until the sheet element portion is released from the effect of the suction force.

A stop element (not shown) may be located at a predetermined position in the path of the sheet element portions 61 and this serves to locate the leading edge of each sheet element portion 61 which is conveyed to that position, so that successive sheet element portions are accurately positioned relative to one another. Alternatively, a frame arrangement can be adopted to accurately position each sheet element portion as it is released from the suction force applied by the pad formation facility.

In the formation of the pad block, it is preferable to include a counting mechanism to count the number of sheet elements portions 61 which are assembled in the pad block assembly location. In this respect, it is possible to install an electronic or manual counter to monitor the number of revolutions made by the rotary guillotine 60, as each revolution directly corresponds to the formation of a separate sheet element portion 61. By monitoring the number of sheet element portions conveyed to the pad block assembly location, the number of sheets per pad can be determined. Other forms of counting means and their location may well be applicable for this operation and the invention is not to be limited to that described.

Once the number of sheet element portions sufficient to form a pad block have been assembled and adhered together, further conveying means may be employed to convey the formed pad block away from the assembly location. In this respect, a conveyor belt 75 located between conveyor rollers 76 and 77 may be used to convey the pad away from the assembly location. Conveyor roller 76 is preferably located underneath the leading edge of the pad block such that the conveyor belt is always in contact with the underneath of the pad block and thus, upon actuation of the conveyor belt 75, the pad block will be dragged along with the conveyor belt 74. In this arrangement, the conveyor belt 75 runs intermittently and only when the correct number of sheet element portions have been assembled in pad block form. Electronic communication between the counter and the conveyor belt 75 can be used to ensure that the conveyor belt operates at the correct interval, although manual control of the conveyor belt may also be appropriate. The pad may be removed from the machine 10 at this point or alternatively, further conveying means may be employed to move the pad to a further location for removal or further processing.

The pad block now formed is suitable for guillotining or other such-like processing to separate one side of the pad block from the other. If the pad block includes provision for more than two pads, then processing will be required both to separate either sides of the pad block, as well as separating longitudinally the individual pads. Such processing may all be conducted with a guillotine.

While the embodiment of the invention described in relation to Figures 2 to 7, is directed to the processing of a sheeting roll 14, which is of a width sufficient to have a segment 41 removed, thereby forming sheet portions 42 and 43, it must be understood that the invention is not limited to a sheeting roll of such a width, but also encompasses a sheeting roll having a width equal to only one of the sheet portions 42 or 43 and the tape roll 13 applies tape to only one edge portion 3. In this case, the machine may be assembled so that a pad requiring no further processing, ie. guillotining, is produced in the first instance, although for efficiency, it is preferable that the pad blocks be of a surface area suitable to multiple pads to be formed, be provided. Conversely, it is within the scope of the present invention to assemble a machine capable of applying adhesive tape 13 to a plurality of edges produced laterally across a width of sheeting 29 by a plurality of cutting assemblies 33.

It is likely that the sheeting roll 14 will include printing such that the pads eventually produced will exhibit information and/or advertising material. Thus the setting of the machine may depend on the printing applied to the sheeting roll 13.

The invention thus provides an effective and efficient method and machine for the production of pads.

Those skilled in the art will appreciate that there may be many variations and modifications of the configuration described herein which are within the scope of the present invention.

Claims

1. A method of forming a pad (1) having a plurality of sheet elements (2) interconnected along an edge portion (3) thereof by adhesive tape (4), said method including feeding a strip of sheet element material (29) to a tape applying station (46), applying adhesive tape to said sheet element strip in such a manner as to overlap an edge portion (3) thereof to form a composite band (56) of material, superimposing a plurality of layers of said composite band (56) at a pad formation facility (59) in order that the overlapping tape portion of one layer adheres to an immediately adjacent layer to form a pad block.

2. A method according to claim 1, wherein each said composite layer is conveyed by conveying means to said pad formation facility (59) and wherein said conveying means includes suction means to engage each said layer.

3. A method according to claim 2, wherein said conveying means includes a conveying belt (62,63) extending between said tape applying station (46) and said pad formation facility (59) and wherein said suction force acts to bring each said composite layer (56) into contact with said conveying belt (62,63) in order that said composite layer (56) moves with said conveying belt (62,63) for transfer to said pad formation facility (59).

4. A method according to claim 2 or 3, wherein release means (71) are employed to release each said composite layer (56) at said pad formation facility (59) from the influence of said suction means.

5. A method according to any one of claims 1 to 4, wherein pressure is applied at said pad formation facility (59) to each said composite layer (56) at least along the layer of adhesive tape in order to adhere each said composite layer to the immediately adjacent composite layer.

6. A method according to any one of claims 1 to 5, wherein said sheet element material (29) is supplied in a continuous form and wherein said adhesive tape is applied continuously to said edge portion (3) of said sheet element material (29) to form a continuous composite band (56), and wherein separation means (60) is applied to said continuous composite band (56) to separate it into separate layers of composite band (61).

7. A method according to claim 6, wherein rotary cutting means (60) are employed to separate said continuous composite band (56) into separate layers of composite band (61).

8. A method according to claim 6 to 7, wherein sensing means communicate with the separation means (60) to determine at which point along the continuous composite band (56) separation should take place.

9. A method according to any one of claims 1 to 8, wherein said sheet element material (29) is at least twice the width of the desired pad block width, and wherein cutting means (33) are employed to sever said sheet element material (29) longitudinally into at least two sub sheet element portions (42,43) of reduced width.

10. A method according to claim 9, wherein said tape is applied to said sheet element material (29) after said cutting means (33) has severed said sheet element material (29) longitudinally.

11. A method according to claim 9 or 10, wherein said cutting means (33) removes an intermediate section (41) of said sheet element material (29) to form two separate and longitudinally spaced sheet element portions (42,43) of reduced width.

12. A method according to claim 11, wherein said tape is applied to the sheet element material (29) after removal of the intermediate section (41) and wherein said tape is applied so that it bridges the longitudinal gap between the longitudinally spaced reduced width sheet element portions (42,43), thereby connecting said reduced width sheet element portions together to form said composite band (56).

13. A method according to claim 12, wherein a pad block formed from composite band layers of reduced width sheet element portions (42,43) spaced apart and connected by a tape bridge, may be separated longitudinally through the tape bridge by guillotining or the like to form separate reduced width pad blocks (1).

14. A method according to any preceeding claim, wherein said pad block once formed is conveyed away from said pad formation facility by further conveying means and converted as necessary to

form pads of a desired size.

15. A machine (10) for forming a pad having a plurality of sheet elements (2) interconnected along an edge portion (3) thereof by adhesive tape, said apparatus including feed means (11) for feeding a strip of sheet element material (29) to tape applying means (46) which is operative to apply adhesive tape to said sheet element material (29), said application being such that the tape extends in the longitudinal direction of the sheet element material (29) and overlies a longitudinal edge portion of said material (29) so as to adhere to that edge portion and form a composite band (56) of material, successive layers (61) of said composite band (56) being assembled together at a pad formation facility (59) such that said successive layers are adhered to the immediately adjacent layer by the adhesive tape to form a pad block.

16. A machine according to claim 15, wherein conveying means (62,63) are provided to convey each said composite band layer (61) to said pad formation facility (59).

17. A machine according to claim 16, wherein said conveying means (62,63) includes suction means for applying suction effect to each said composite band layer 61 and a conveying belt (62,63) against which the composite band layer (61) may be influenced under the effect of the suction means.

18. A machine according to claim 17, wherein said conveying belt (62,63) includes openings (70) through which the suction effect acts to bring the composite band layer (61) into contact with the conveying belt (62,63).

19. A machine according to claim 18, wherein release means (71) are provided to release each said composite band layer (61) from the influence of said suction effect.

20. A machine according to claim 19, wherein said release means (71) includes an actuator bar (71) which exerts a force on said composite band layer (61) opposite to the suction force acting on that layer to separate the composite band layer (61) from the influence of said suction effect.

21. A machine according to any one of claims 15 to 20, wherein said pad formation facility (59) includes pressure application means to apply pressure to said successive layers of said composite band (61) to ensure adhesion between said successive layers.

22. A machine according to claim 21, wherein said pressure application means takes the form of the release means (71) such that the release means (71) acts to release the composite band layer (61) from the suction effect and to apply pressure to the composite band layer 61 to ensure adhesion between successive layers.

23. A machine according to any one of claims 15 to 22 including supply means (11) suitable to feed a continuous supply (13) of sheet element material (29) to said tape applying means (46).

24. A machine according to claim 23, wherein said supply means (11) includes a rotatable shaft (12) on which a roll of sheet element material (13) may be provided, said supply means (11) further including control means (19) to control the rotation of said sheet element roll (11) about said rotatable shaft (12).

25. A machine according to claim 24, wherein said control means (19) includes a braking mechanism or a clutch mechanism.

26. A machine according to any one of claims 15 to 25, wherein said tape applying means (46) includes a tape roll (47) mounted on a rotatable shaft (48), said shaft (48) being drivable by driving means.

27. A machine according to claim 26, wherein said driving means is variable so that the rotative speed of said shaft (48) and said tape roll (47) may be varied upon reduction in diameter of said tape roll as tape is fed from it.

28. A machine according to any one of claims 23 to 27, wherein separating means (60) are employed to separate said continuous supply of sheet element material (29) into separate discrete sheet element portions (61).

29. A machine according to claim 28, wherein said separating means includes a rotary knife edge cutting assembly (60) which rotates on an axis transverse to the path of the composite band (61) and operates to cut said composite band (56) at predetermined intervals of a desired length.

30. A machine according to claim 29, wherein sensing means are provided to control the rotation of the rotary knife edge cutting assembly (60) and wherein the sensing means operates to sense markers existing on the composite band, or existing on a rotary disc which is calibrated to rotate at an appropriate angular velocity relative to the passage of the composite band past the rotary

knife edge cutting assembly (60).

31. A machine according to any one of claims 15 to 30, wherein said sheet element material (29) has a width suitable for the eventual formation of more than one pad (1), and wherein said apparatus includes cutting means (60) to sever said sheet element material (29) longitudinally.

32. A machine according to claim 31, wherein said cutting means (60) includes a cutting assembly suitable to remove an intermediate portion (41) of said sheet element material (29) prior to said tape applying means (46).

33. A machine according to claim 32 wherein said cutting assembly (60) includes a cutting wheel (33) having a pair of spaced apart annular knife edges (36) extending about the circumference of said cutting wheel (33), and a mating wheel (38) of a width to fit between said spaced apart knife edges (36), such that said sheet element material (29) is passed between said cutting wheel (33) and said mating wheel (38) so that said mating wheel (38) draws said sheet element material (29) into contact with said knife edges (36) to sever said material (29) along that line of contact and thereby remove an intermediate portion (41) of the sheet element material (29).

34. A machine according to claim 32 or 33, wherein said adhesive tape is applied to the spaced apart edge portions of the sheet element material (29) from where the intermediate portion (41) has been removed so that the applied adhesive tape bridges and connects the spaced apart edge portions to form a composite band (61).

35. A pad formed by the machine defined in any one of claims 15 to 34.

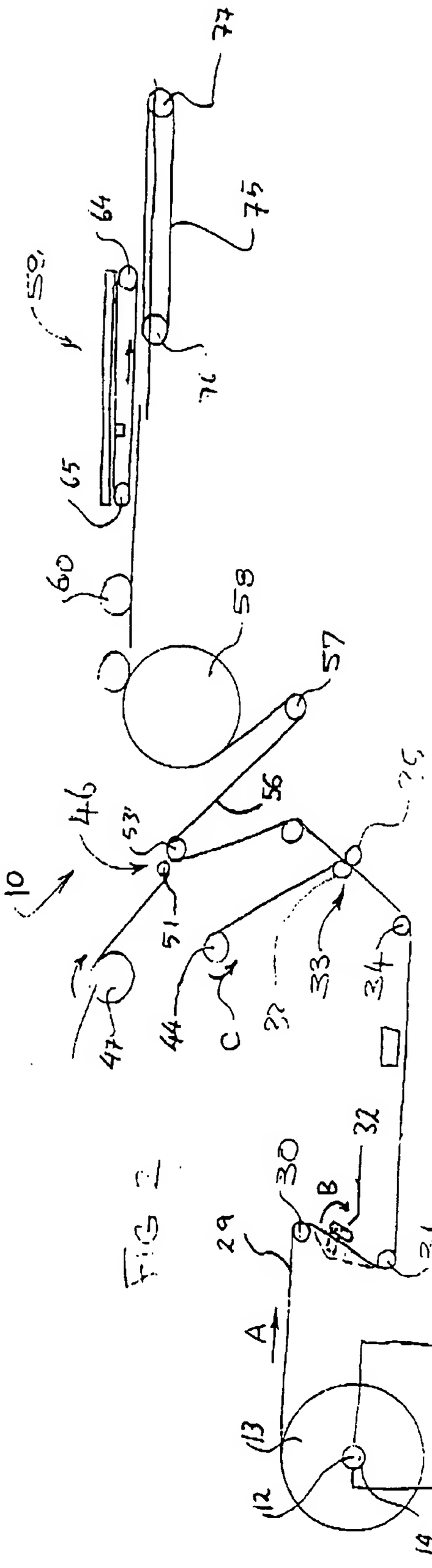
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FIG 1

FIG 4

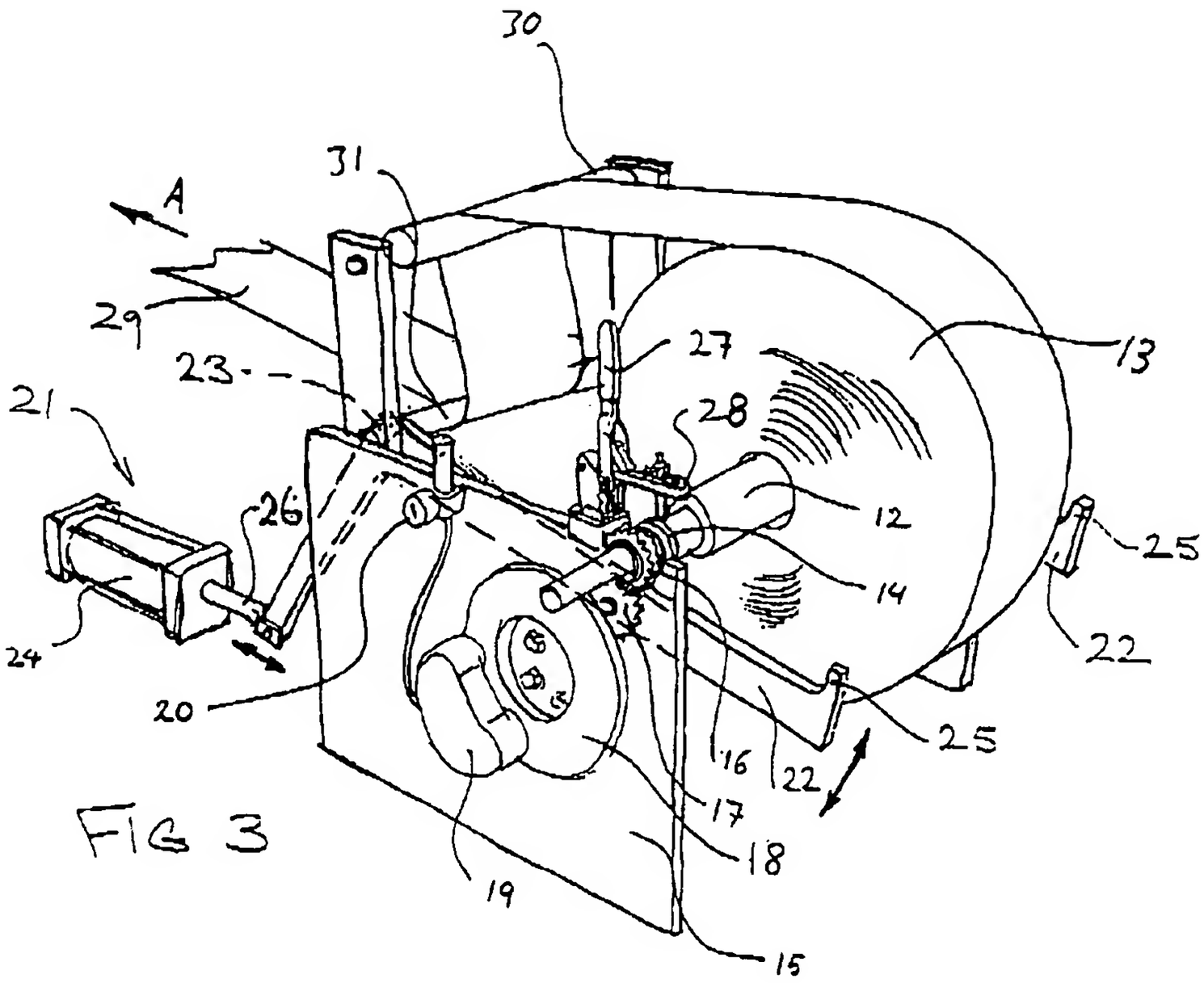
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FIG 3

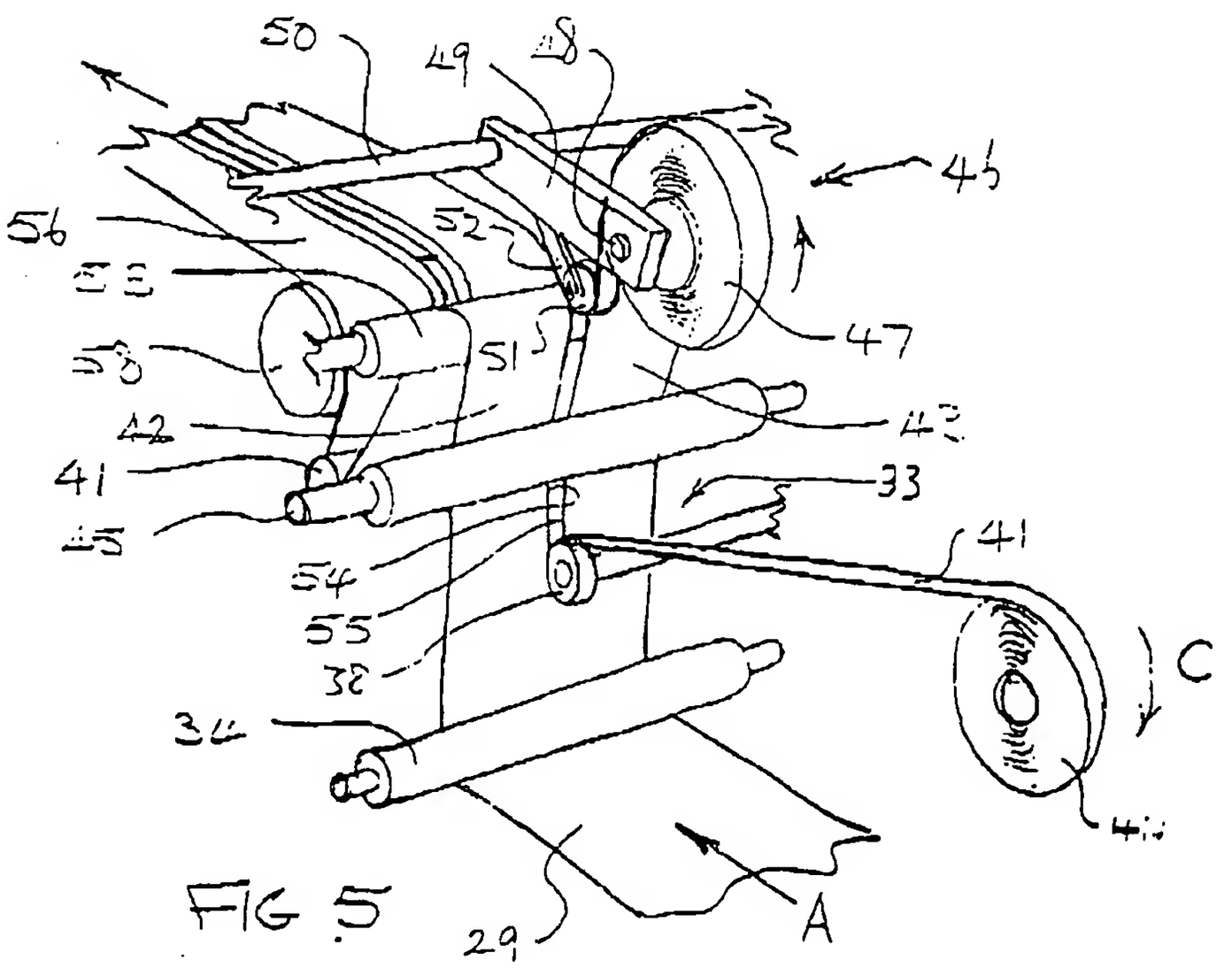
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FIG 5

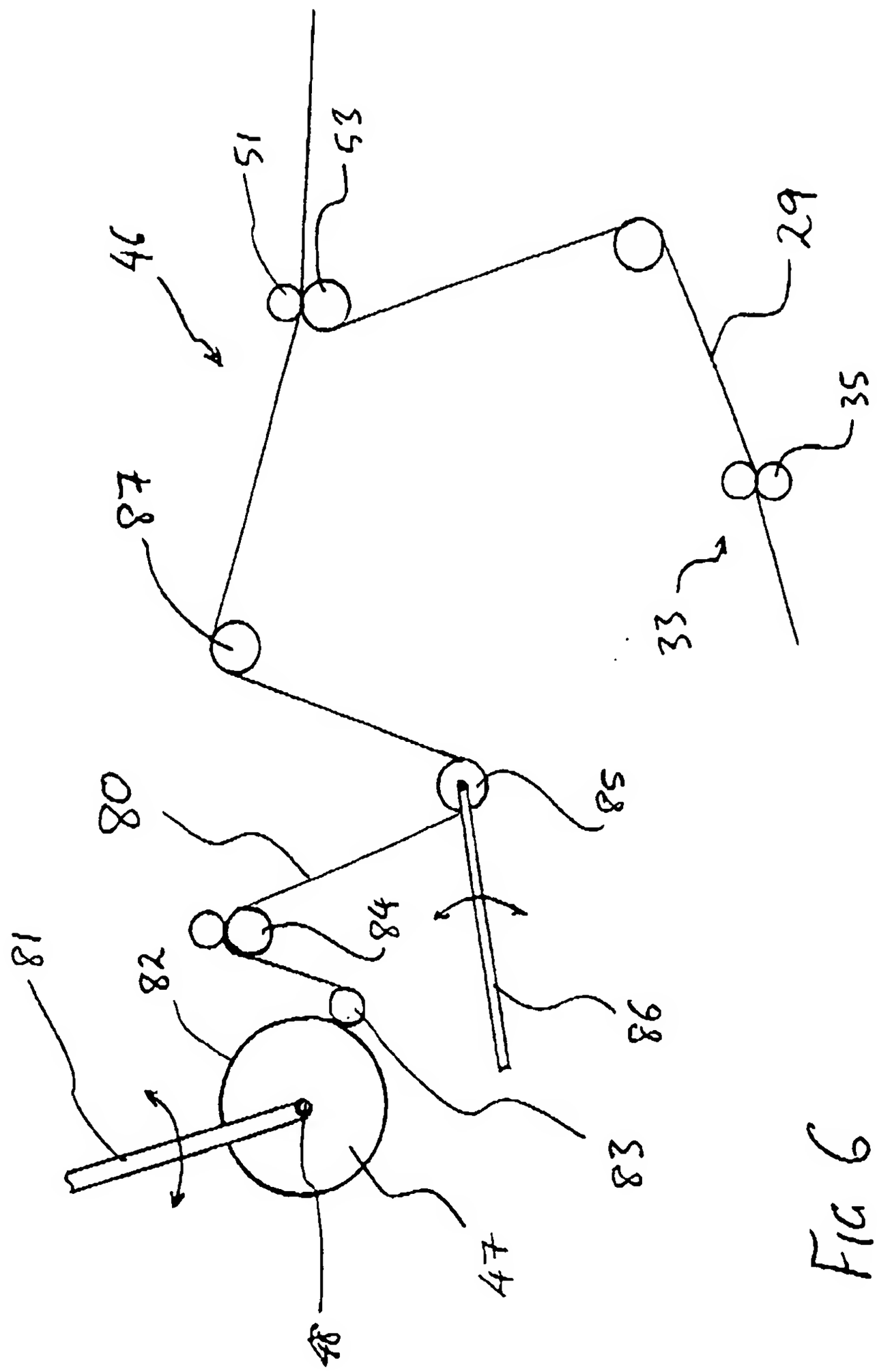

FIG 6

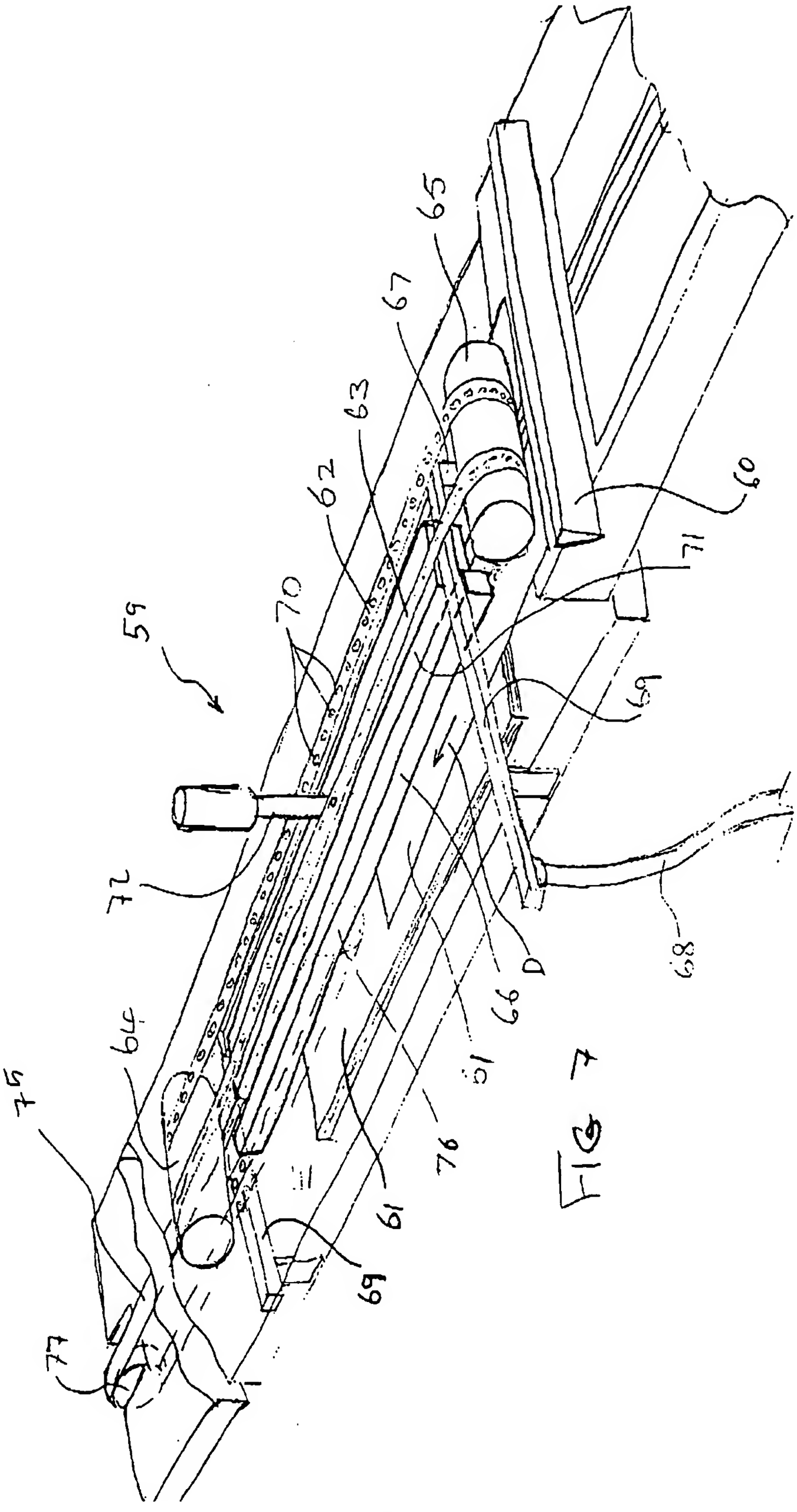

FIG 6

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 95 30 0312

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
A,D	AU-A-43 642 (BANSON NOMINEES PTY.) 2 August 1979 * the whole document * -----	1,15	B42C3/00 B42C9/00

TECHNICAL FIELDS SEARCHED (Int.Cl.6)

B42C
B42D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	2 May 1995	Evans, A

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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